CUSTOMER NO.: 38107

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of T. NETSCH, et al.	)	Examiner: R. LI
	)	Art Unit: 2624
Serial No.: 10/596,467	)	Confirmation: 6961
Filed: June 14, 2006	)	
For: **METHOD FOR THE COMPUTER-ASSISTED VISUALIZATION OF DIAGNOSTIC IMAGE DATA**	)	
Date of Final Rejection: January 27, 2010	)	
Attorney Docket No.: DE030426US1/PKRZ 201596US01	)	Cleveland, OH 44114 July 23, 2010

APPEAL BRIEF

Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an Appeal from the Final Rejection of January 27, 2010.

The 37 CFR 41.31 Notice of Appeal was filed May 27, 2010.

An authorization to charge the 37 CFR 41.20(b)(2) Appeal Fee to the applicant's Deposit Account accompanies this Brief.

CERTIFICATE OF ELECTRONIC TRANSMISSION

I certify that this **APPEAL BRIEF** and accompanying documents in connection with U.S. Serial No. 10/596,467 are being filed on the date indicated below by electronic transmission with the United States Patent and Trademark Office via the electronic filing system (EFS-Web).

July 23 2010
Date

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(i) REAL PARTY IN INTEREST

The Real Party in Interest is the Assignee, KONINKLIJKE PHILIPS ELECTRONICS, N.V.

(ii) RELATED APPEALS AND INTERFERENCES

None.

(iii) STATUS OF CLAIMS

Claims 1, 4, and 6-9 stand rejected

Claims 2, 3, 5, 10 and 11 have been cancelled.

All rejected claims, particularly claims 1, 4, and 6-9 are being appealed.

No claims stand allowed.

(iv) STATUS OF AMENDMENTS

An Amendment accompanies the present Brief. The Amendment corrects objectionable content (or lack of content) in the specification. Because this Amendment cures the Examiner's objection and places the application in better condition for appeal, while not amending the claims or otherwise raising issues that would require further search or consideration, it is believed that this Amendment will be entered.

(v) SUMMARY OF CLAIMED SUBJECT MATTER

1. A method for the computer-assisted visualization of a three-dimensional anatomical object, comprising the following method steps:

a) recording two or more diagnostic image data records **{1, 3, 4, 5}** of the object wherein at least one image data record **{1}** comprises morphological image information of the anatomical object and at least one further image data record **{3, 4, 5}** comprises functional image information relating to the anatomical object; **{p. 3, l. 14-15; p. 5, l. 11-17; p. y, l. 21-34; Fig. 1}**

b) defining an imaging specification for imaging the image data onto a two-dimensional display plane **{8}**, the definition of the imaging specification involving the identification of anatomical features **{2}** of the object in at least one of the image data records **{1}** and the determination of an object volume delimited by a curved surface **{7}** in which the anatomical features of the object are contained; **{p. 3, l. 14-18; p. 4, l. 22-30; p. 7, l. 1-13; Fig. 1}**

c) calculating a combined two-dimensional representation by imaging the two or more image data records **{1, 3, 4, 5}** according to the previously defined imaging specification onto the common display plane **{8}** wherein a projection of the image information of the data records that is contained in the object volume **{7}** is calculated during the calculation of the two-dimensional representation. **{p. 2, l. 18-20; p. 4, l. 28-33; p. 7, l. 14-25; Fig. 1}**

4. A method as claimed in claim 1, wherein in order to calculate the two-dimensional representation Cartesian coordinates within the display plane are assigned to non-Cartesian surface coordinates of the object volume. **{p. 4, l. 33- p. 5, l. 10; Fig. 1}**

6. A method as claimed in claim 1, wherein the functional image information is obtained by evaluating temporal sequences of morphological image data of the anatomical object. **{p. 5, l. 17-23; Fig. 1}**

7. A method as claimed in claim 1, wherein at least one of the image data records comprises at least one slice image of the anatomical object. **{p. 5, l. 24-27; p. 6, l. 26-32; Fig. 1}**

8. A method as claimed in claim 1, wherein the image data records are recorded by means of computer tomography, magnetic resonance or ultrasound. **{p. 5, l. 28-33; p. 7, l. 26 – p. 8, l. 9; Fig. 2}**

9. A method as claimed in claim 1, wherein the image data records are recorded using different imaging modes. **{p. 5, l. 28-33; Fig. 2}**

(vi) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 1, 4, and 6-9 distinguish patentably in the sense of 35 U.S.C. § 103 over Moshfeghi (US 5,633,951) as modified by Front (US 2001/0041835).

(vii) ARGUMENT

A. The Combination of Moshfeghi and Front is Inoperative

At column 4, lines 15-27 of Moshfeghi, referenced by the Examiner, Moshfeghi combines or merges two morphological images, particularly a magnetic resonance (MR) and a computed tomography (CT) image. As Moshfeghi points out, the CT image typically has better spatial resolution than the MR image. Moreover, although the CT image is good for visualizing bone, the contrast between different types of soft tissue is often weak and difficult to distinguish. By distinction, MR images have excellent soft tissue differentiation, giving different contrast levels (gray scale) between various organs and tissue types. Bone, like air, produces substantially no MR signal and is substantially missing from the MR image. Moshfeghi proposes to combine the MR and CT images to generate a combined image which, Moshfeghi suggests, has the best of both imaging modalities.

In order to generate the combined image, Moshfeghi wants to scale the MR and CT images to be of precisely the same scale and shifts, translates, rotates, etc. the CT and MR images such that they are exactly aligned. When the images are exactly aligned, the same voxel in the MR image, the CT image, and the combined image all represent the exact same incremental element of the imaged physiology.

At column 5, line 21- column 12, line 7, Moshfeghi describes a technique for aligning the two morphological images, which will not work to align the morphological image (Fig. 2B) and the functional image (Fig. 2A) of Front. Because the CT and MR images are both morphological images, various organs and contours are visible in both, e.g., the heart, liver, spleen, etc. Moshfeghi proposes to segment these various organs and contours in both the MR image and the CT image. That is, Moshfeghi proposes to identify the surface which describes the surface of the organ or the surface of other contours that are identifiable in both the MR and CT images. For example, Moshfeghi might define the surfaces or contours that define the outer surface of the heart, the outer surface of the liver, the outer surface of the spleen, and/or other interior organs or surfaces. As noted above, the CT images and the MR images each have better abilities to identify some of these surfaces or the interfaces between some adjacent organs and a weaker ability to identify the surfaces or

interfaces between other organs or tissues. Nonetheless, each is able to substantially define the surfaces (although there may be some missing or approximated regions). Once the surfaces and interfaces are identified in both the CT and the MR images, Moshfeghi registers these surfaces. For example, the surface of the heart in the CT and MR images are scaled, translated, rotated, etc. to bring them into alignment. Similarly, other organs and interfaces are also scaled, shifted, rotated, and the like.

It might be noted that Moshfeghi is proposing to align regions or subparts of the overall 3D image rather than just trying to align the 3D volume as a whole. This alignment of the various subregions of the overall 3D image assure improved accurate local alignment or registration.

In order for the technique of Moshfeghi to work or be operative, one must be able to segment and identify the corresponding surfaces in both of the images to be aligned. As indicated above, this works well for two morphological images. However, this technique fails when applied to the functional image of Fig. 2A of Front.

In Front, the functional image of Fig. 2A is a PET image. To generate the functional image, the patient is injected with a radiopharmaceutical, such as one which includes Ga-67, connected with an organic molecule, such as a sugar. Tumors have a veracious appetite and preferentially absorb the radiopharmaceutical.

In PET imaging, the image depicts the distribution of the radiopharmaceutical in the body. That is, in PET imaging, the only data that is reconstructed is the pairs of simultaneously emitted gamma rays which are generated each time a Ga-67 isotope decomposes. Thus, the PET image shows no morphological data. Rather, as shown in Fig. 2A, the functional image of Front is a spot TG where the Ga-67 accumulated. Just where in the body the spot or target TG is located cannot be determined accurately from the PET image. Because one knows the field of view of the PET scanner and where the patient was positioned in the PET scanner, one has a general idea of approximately where the target TG is probably located in the anatomy. But, this approximate knowledge is not good enough to perform the needle biopsy which Front proposes.

Because Front shows only the bright spot or target TG and not morphological data, the functional image of Front cannot be segmented to identify the

surface of various organs and tissues or interfaces therebetween. One cannot tell from Fig. 2A where the heart, liver, lungs, spleen, or other tissues, organs, or interfaces may lie.

Because the functional image of Fig. 2A of Front cannot be segmented, it cannot be aligned with a morphological image using the Moshfeghi technique.

Stated more bluntly, if the images input into Moshfeghi were the functional image I_{FUNC} of Fig. 2A of Front and the structural image I_{STRUCT} of Fig. 2B of Front, then the registration or combining technique of Moshfeghi would fail and would be unable to match, register, align, or otherwise combine the two images accurately. Moreover, because large portions of the functional image of Front have substantially no data usable in the Moshfeghi technique, Moshfeghi's stated goal of aligning even images of body regions which exhibit local geometric deformation (column 1, lines 12-17), i.e., achieve accurate local registration, would fail. Thus, using Moshfeghi technique to try to register the functional and structural images of Front as the two input images would fail to result in registration of the images, i.e., Moshfeghi would be rendered inoperative for its intended purpose.

As an aside, Front discloses a different way of aligning the functional and structural images, which is different from and incompatible with the Moshfeghi technique. Specifically, Front straps a harness onto the patient, which harness includes markers 14 which are imageable with both the functional and structural imaging modality. By aligning these markers in both images, the structural and functional images, ***as a whole*** but not locally, are registered or aligned. The Front technique does not achieve the local registration that is one of the objects of Moshfeghi.

Accordingly, it is submitted that the Examiner's proposed combination of Front with Moshfeghi would be inoperative for the intended purpose of Moshfeghi or Front.

B. Claim 1 and Claims 4 and 6-9 Dependent Therefrom Distinguish Patentably Over Moshfeghi as modified by Front

First, as set forth above, Moshfeghi as modified by Front, in the manner proposed by the Examiner, would be inoperative to perform the function of Moshfeghi and the function of Front.

Second, Moshfeghi and Front, as combined by the Examiner, do not show all of the elements of claim 1. Claim 1 calls for two or more diagnostic image records of an object in which one image comprises morphological image information and the other comprises functional image information. Moshfeghi calls for both images to be morphological images. Although Front does suggest a functional image and a morphological image, because the Moshfeghi technique would be inoperative if the functional image of Front were one of the two images, it is submitted that it is not obvious and that one of ordinary skill in the art would not attempt to replace a morphological image of Moshfeghi with the functional image of Front.

Claim 1 further calls for defining an image specification for imaging the image data onto a two-dimensional display plane, which definition of the imaging specification involves the identification of anatomical features of the object in at least one of the image data records, and determining an object volume being limited by a curved surface in which the anatomical features of the object are contained. As explained in the present application starting on page 2, line 30, trying to work with combined three-dimensional images is not optimal for allowing standardized depiction in medical reports. As explained starting on page 3, line 21, three-dimensional representations are avoided and a two-dimensional representation is calculated according to an image specification which is determined uniformly and in a geometrically well-defined manner. A purely two-dimensional representation has the advantage, in particular, of being able to be depicted in a standardized and reproducible manner, for example, in medical reports. Moshfeghi and Front, which both work with three-dimensional combined images, are susceptible to this problem. The present application, as set forth in claim 1, addresses this problem by defining an imaging specification involving the identification of functional features and determining an object volume delimited by a curved surface in which the anatomical features are contained.

Neither Moshfeghi, nor Front, define such an imaging specification nor determine an object volume delimited by a curved surface in which the anatomical features are contained. The Examiner refers the applicant to column 4, lines 22-27 and column 5, lines 32-34 of Moshfeghi. Column 4, lines 22-27 merely enumerate the relative advantages and disadvantages of MR and CT images and do not address either defining an imaging specification or determining an object volume delimited by a curved surface in which the anatomical features are contained. Column 5, lines 32-34 of Moshfeghi referenced by the Examiner, provide an introduction to the preferred segmentation process in which surfaces of various organs or tissues are determined, preferably with user interaction (column 5, lines 39-41). Thus, this portion of Moshfeghi also does not disclose defining an imaging specification or determining an object volume delimited by a curved surface in which the anatomical features are contained.

Claim 1 further calls for calculating a combined two-dimensional representation by imaging the two or more data records according to the previously defined imaging specification onto a common plane wherein a projection of the image information of the data records that is contained in the object volume is calculated during the calculation of the two-dimensional representation. The Examiner refers the applicant to column 4, line 65 – column 5, line 4 of Moshfeghi and elements 18 and 20 of Figure 1 of Moshfeghi. However, this section of Moshfeghi merely refers to displaying a combination of the registered first and second morphological images on a monitor. This section of Moshfeghi does not suggest calculating a combined two-dimensional representation according to the previously defined imaging specification. In the middle of page 3 of the Office Action, the Examiner indicates that he is reading defining an imaging specification as being when images are either obtained by obtaining 2D slices, without translating the table, and combined to form a 3D image, or obtaining a 3D image wherein the table is translated respective to the imaging device. That is, the Examiner is interpreting imaging specification as relating to how a 3D image data set is built. By distinction, in Moshfeghi, how a 3D image is built is not relevant to the generation of a projection image. Front is not cited as and does not cure this shortcoming of Moshfeghi.

Accordingly, it is submitted that claim 1 and claims 4 and 6-9 dependent therefrom distinguish patentably and unobviously over the references of record.

C. Claim 4 Distinguishes Patentably Over the References of Record

Claim 4 calls for the two-dimensional representation in the display plane to have Cartesian coordinates, which Cartesian coordinates are assigned to non-Cartesian coordinates in the image volume. The Examiner refers the applicant to column 6, lines 64-66 and column 8, lines 26-30 of Moshfeghi. Column 6, lines 64-66 of Moshfeghi are not concerned with projecting a two-dimensional representation onto a display plane. Rather, this section of Moshfeghi is concerned with aligning the segmented surfaces of the two morphological images by minimizing internal energy at a local contour point. These steps of Moshfeghi take place in the registration process and not in the generation of the 2D image which is generated on the display 20 after the volume images have been registered.

Column 8, lines 26-31 of Moshfeghi are also directed to registering the segmented surfaces. Specifically, the segmented surfaces in the two images are defined by triangular meshes. This section of column 8 of Moshfeghi is concerned with aligning the vertices of the respective meshes during the registration process. This section does not relate to the projection of a 2D image for display on the display 20 of Moshfeghi.

Accordingly, it is submitted that claim 4 distinguishes patentably over the references of record.

D. Claim 6 Distinguishes Patentably Over the References of Record

Claim 6 calls for the functional image information to be obtained by evaluating a temporal sequence of morphological image data of the anatomical object. The Examiner refers the applicant to paragraph [0014] of Front, which is asserted to show the functional images are in real-time. However, claim 6 calls for evaluating temporal sequences. There is nothing in paragraph [0014] of Front about evaluating a sequence of images.

Moreover, claim 6 calls for evaluating a temporal sequence of morphological image data. In paragraph [0014] and other sections of Front, the functional image data is obtained from PET or SPECT imaging, which is a functional imaging technique, not a morphological imaging technique, much less a sequence of morphological images. The SPECT or PET scanner does not obtain the functional information by evaluating a sequence of morphological image data. Rather, Front obtains the functional image information by integrating functional image data, particularly the location of Ga-67 radiation decay events over time to identify the bright spots in which the Ga-67 is accumulating, which bright spots are indicative of a tumor or target TG. Thus, Front neither obtains the functional image data from morphological image data nor does Front evaluate a temporal sequence of morphological image data.

Moreover, paragraph [0014] of Front does not, as asserted by the Examiner, describe functional images as being temporal images in real-time. Rather, paragraph [0014] of Front is a repetition of Section (I) of claim 1 of Front, which suggests providing a combined image which includes the target. There is nothing in this paragraph about a sequence of images, much less a sequence of morphological image data, or whether the images are or are not real-time images. It is submitted that in Front, neither the morphological image nor the functional image are real-time images. The only point at which Front suggests images which might be close to real-time images is in paragraph [0060], in which after the combined images are generated and the biopsy is fully planned, one might check the location of the biopsy needle to be sure that it is in the location and has a trajectory as planned from the combined image which was previously displayed on display 22.

Accordingly, it is submitted that claim 6 distinguishes patentably over the references of record.

E. Conclusion

For the reasons set forth above, it is submitted that claims 1, 4, and 6-9 distinguish patentably and unobviously over the references of record. An early reversal of all of the Examiner's rejections is requested.

Respectfully submitted,

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(viii) CLAIMS APPENDIX

1. (Rejected) A method for the computer-assisted visualization of a three-dimensional anatomical object, comprising the following method steps:

a) recording two or more diagnostic image data records of the object wherein at least one image data record comprises morphological image information of the anatomical object and at least one further image data record comprises functional image information relating to the anatomical object;

b) defining an imaging specification for imaging the image data onto a two-dimensional display plane, the definition of the imaging specification involving the identification of anatomical features of the object in at least one of the image data records and the determination of an object volume delimited by a curved surface in which the anatomical features of the object are contained;

c) calculating a combined two-dimensional representation by imaging the two or more image data records according to the previously defined imaging specification onto the common display plane wherein a projection of the image information of the data records that is contained in the object volume is calculated during the calculation of the two-dimensional representation.

2-3. (Cancelled)

4. (Rejected) A method as claimed in claim 1, wherein in order to calculate the two-dimensional representation Cartesian coordinates within the display plane are assigned to non-Cartesian surface coordinates of the object volume.

5. (Cancelled)

6. (Rejected) A method as claimed in claim 1, wherein the functional image information is obtained by evaluating temporal sequences of morphological image data of the anatomical object.

7. (Rejected) A method as claimed in claim 1, wherein at least one of the image data records comprises at least one slice image of the anatomical object.

8. (Rejected) A method as claimed in claim 1, wherein the image data records are recorded by means of computer tomography, magnetic resonance or ultrasound.

9. (Rejected) A method as claimed in claim 1, wherein the image data records are recorded using different imaging modes.

10-11. (Cancelled)

(ix) EVIDENCE APPENDIX

None.

(x) RELATED PROCEEDINGS APPENDIX

None.